epidemic itself. It must not be forgotten that many other milkmen besides the one concerned served other houses in this district, which is thickly settled, but in none of these was there any fever. The correspondence of the cases of typhoid fever with their milk-supply is plain, although, as would be expected, some houses served by this milkman had no fever. There is good reason to believe that the infected milk was not the only kind that he carried, and that a different milk was sometimes delivered, for example, in the Ingersoll Grove district.

It will be observed that there were a few cases of typhoid fever in other parts of the city. A very few of these were imported. Of the others, those on Tenth and Essex Streets deserve special comment. After the milkman became alarmed, he is known to have refused, for a time, to take milk from the dairy in question. We have positive evidence that milk from this dairy afterwards went to Essex Street; and that here, also, the fever appeared, is one of the strongest links in our chain of intrinsic evidence. Similarly, seven cases of typhoid fever suddenly appeared about August 20th, in an hotel in the heart of the city; and while no positive evidence was found that milk from the infected dairy went to this hotel, we did discover that, at the time when this milk was under a cloud and was held by the Association, one can of reserved milk (ten quarts) was sold by them to that hotel, that this was an unusual occurrence, and at the very time required to have conveyed the disease to the hotel. As for the rest of the city, it was throughout the epidemic period almost wholly free from typhoid fever. The annual autumnal wave had not yet begun to rise.

The whole number of cases discovered and investigated was one hundred and fifty, and the whole number of deaths belonging to the epidemic was twenty-five. The intensity of the epidemic may be seen upon the accompanying diagram of monthly mortality from typhoid fever, which shows well also the limits of the epidemic period. A study of the death-rate from typhoid fever in Springfield, by months for the twelve years, 1881–92, shows a marked improvement since 1883, and an enormous excess in August, 1892, at the height of the epidemic. The death-rate from typhoid fever during this month was by far the highest during any month of the entire twelve-year period.

Out of the whole number of cases, one hundred and fifty, one hundred and one had milk sold by the same milkman (F. D. K.), while one hundred and thirty-five may have had access to the same milk.

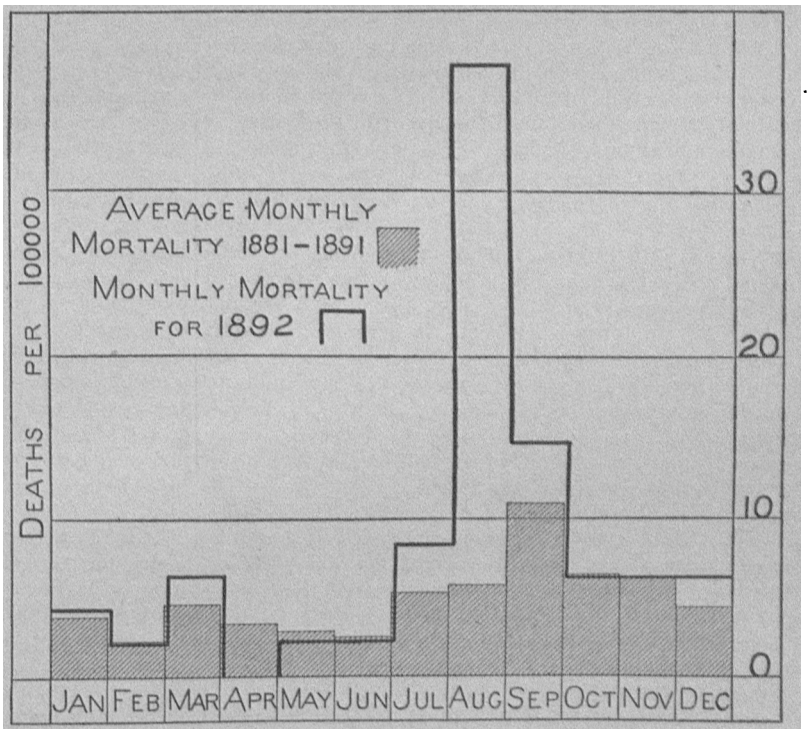
For aid in the preparation of the map and diagram, we are indebted to Mr. R. D. Chase.

A LONDON surgeon recently completing a laparotomy, gave his needle a flourish that took out the lens from the eye of an unfortunate assistant.

AN INVESTIGATION OF AN EPIDEMIC OF TYPHOID FEVER IN SOMERVILLE, MASSACHUSETTS, DUE TO INFECTED MILK.[1]

BY WILLIAM T. SEDGWICK, PH.D.,
Biologist of the State Board of Health of Massachusetts.

TOWARDS the end of August, 1892, the attention of the Somerville Board of Health was drawn to a sudden and nearly simultaneous appearance of a number of cases of typhoid fever. The physicians reported the cases with commendable promptness, ten having been reported on August 23d alone, and an inquiry set on foot by the local Board of Health immediately revealed the fact that most, if not all, of the cases were served by one and the same milkman. Thereupon the Somerville Board reported the outbreak to the State Board of Health, and I was instructed to make an investigation. In view of recent experience in the Springfield epidemic, described in a previous paper, which I was still studying, I was able to work rapidly, and began by verifying the data already in hand. It afterwards appeared that during the three weeks, August 20th to September 10th there were in the entire city of Somerville thirty-five (35) cases of typhoid fever. Of these one was imported, one was plainly a secondary case, a third was a very old case tardily reported. Thirty-two (32) cases were apparently primary and indigenous and remained to be accounted for. Thirty (30) of these had been served with, or had had access to, milk supplied by one and the same milkman. Of the other two cases, one was an old case of which the diagnosis was uncertain, though there was also a possibility that it was itself secondary to an earlier one; the other was synchronous with the epidemic period, and was that of a young woman who was in the habit of buying milk at



[1] From the forthcoming Report of the State Board of Health of Massachusetts, for 1892.

a certain bakery. A bakery next door to the one from which she was in the habit of buying milk was supplied with milk by this particular milkman, and the keeper of this bakery and her daughter were among the persons who suffered from typhoid fever. I could not get the young woman or her mother to admit that they had ever been in the nearer bakery which had the suspected milk; but as they had to pass it to get to their regular bakery, I cannot keep feeling that on some unusual occasion some member of the family had perhaps stepped into the nearer bakery and got some milk. This case coincided in time with the rest; but in view of the evidence I have considered it an unexplained case.

The usual theories of water infection, sewer emanations, etc., were advanced by some to account for the outbreak, but were all easily disproved. The city of Somerville uses the "Mystic" water-supply of the city of Boston, and this supply is not altogether unobjectionable but, inasmuch as the same supply served the whole city as well as the neighboring cities of Charlestown and Chelsea, while the present outbreak was confined to a limited area, the theory of wholesale water infection was easily disposed of. The region most affected was a fine portion of the city with the houses in excellent sanitary condition. There was no reason to suppose that the air, water, ice or sewers were worse here than anywhere else. The only common bond of connection between the infected families which was not also shared by thousands of others who were uninfected was the milk-supply; and even this was shared by a large number of families in one portion of the city in which no fever appeared. It became necessary, therefore, before adopting the theory of infection by contaminated milk to show not only (1) how the milk might have become contaminated, but also (2) how it happened that only one portion of the milkman's route was affected with typhoid fever, while another and important portion was not so affected.

I addressed myself first to the problem of the infection of the milk, and after having interviewed the milkman at great length for the sake of mastering the details of his business, visited the farms (in Littleton) from which the milk was said to have come. All of these proved to be free from typhoid fever, and to be examples of unusually decent dairies. From Littleton the milk was sent once a day to Somerville, arriving by train early in the forenoon at the Union Square station. I was further informed that from this point it was carried in a wagon, still in the cans used for shipment, holding eight and one-half quarts each, to a kind of barn called the "milk house" near the residence of the milkman. I was also told that in the milk house the milk was "mixed" by being poured from the large cans into the mixer, a capacious upright metal tank provided at the bottom with a faucet. After mixing (to produce an even grade) the milk was drawn off into the small cans supplied to consumers, these being next stoppered with wooden plugs and finally set away in the ice box, where they were "iced" and stored until early the next morning. At daybreak or earlier these small cans were delivered to the consumers by means of two wagons, each having a special route and a special series of customers. Inquiry showed that in proportion to the number of takers the cases were about equally distributed upon the two routes, which indicated that the infection must have existed in the mixer or in the cans, or possibly in both. The milkman-in-chief had two sons, one of whom was lying dead of typhoid fever when I first arrived on the spot. The date of the report of his case, however, agreed closely with that of the other sufferers from the disease, and he was also said to have been a great drinker of milk, so that he appeared to be simply a sharer in the common calamity. This son (W. B.), I was told, drove one of the wagons and worked in the milk house, but never handled the milk. It was his duty merely to wash the cans, while his brother, who drove the other wagon, "handled" the milk. This brother was not attacked by the disease.

Thus far it appeared that the milk had unquestionably arrived in the city uninfected, and had been carried in the unopened cans directly to the milk house, still uninfected; but when it left the milk house in other cans, some of it, at least, must have been infected. There was but one logical conclusion, namely, that it had somehow got infected in the milk house. I therefore investigated more closely the case of the son (W. B.) who had just died of typhoid fever, and was rewarded by the discovery that, although his case had indeed been promptly reported by his attending physician, and thus apparently belonged with the rest, it was in reality much older than the others, and dated from a time early enough to allow him to have contaminated the milk, and thus to have been the unfortunate cause of the whole trouble. This young man had first consulted another physician, who had failed to inform him of the true character of his disease, and, instead of putting him to bed, had allowed him to keep on with his work until finally the fever affected him so seriously that he could hardly keep his seat on his wagon, and at last, in desperation, consulted a competent physician. Then, and not before, his case was recognized and reported, and he was sent to bed; but so far was the disease advanced that the next day he had one intestinal hæmorrhage, followed before long by others of great severity; and very soon after he died.

It is plain that this young man worked in the milk house about, if not at and over, the milk, until he was in an advanced stage of the disease. It was denied by his father and brother that he ever "handled," or, as the phrase is, "set up," the milk, that is, transferred it from the large cans to the "mixer" and then to the little (consumer's) cans. It was alleged that his office in the milk house was simply to wash the cans, never to set up the milk. This point was urged upon me with eagerness and persistence, as fatal to my theory; but without discrediting the honesty of the affirmation, I cannot readily believe from what I have seen and learned of the milk trade, milkmen, milk houses, etc., that a division of labor really existed in this case so complete as would be required to exclude all possibility of infection of the milk by a sick man working within a few feet of the "setting-up" process, and doubtless ready and willing to lend a hand. I do not believe that, when two men are working day after day over milk in one room, one man always and without exception washes cans, while the other always and without exception puts milk into cans.

As to the precise way in which such a person might contaminate the milk there is no difficulty, even if he were only a washer of the cans. If such a person, in the early stages of the disease, affected with diarrhœa, should merely fail to wash his hands on returning from the privy and should then proceed to wash cans or to

help in emptying the cans into the "mixer," particles upon his fingers might drop or be brushed or washed off into the milk. That many people do habitually omit to wash their hands under similar circumstances is a fact.

In spite of these important discoveries, there still remained for some time a very serious objection to the theory that the milk had really been contaminated at the milk house. In the vicinity of Union Square and also to the east and west of this region the same set of milkmen delivered a considerable quantity of milk and served a large number of customers. Here, however, there had been no typhoid fever. I was myself much puzzled by these facts from the start and the milkman-in-chief lost no opportunity of urging them upon my attention as an insuperable objection to the milk-infection theory. At last, however, in the over-eagerness of his affirmations, he himself afforded the clew which enabled me to solve the whole difficulty. In reiterating the importance of the absence of cases upon that portion of the route near Union Square, and saying that more of the milk went thereabouts than on the hill (where the cases had occurred), he added that he knew this because he "always waited around after the train came and gave the boys several cans off the wagon" which they sold directly to the uninfected districts. Immediately everything became plain. These districts had evidently not been infected, *because they had not usually had milk from the milk house*, but had been served with fresh milk just in from Littleton. Probably only enough was taken from the train each day to serve these customers and those upon the hill who would not wait for the train to arrive next day. No more would be carried over than was necessary, because if the supply ran low more could be got in time for use, next day; and milk in August does not keep well. This milkman's route extended over the line into Cambridge, in which city he served three families. I was interested to find in one of these, a case of typhoid fever synchronous with those in Somerville. There was no other case in Cambridge anywhere near this point at that time.

One of the most interesting features of the epidemic was the indication which it afforded that in the very early, and possibly even in the early prodromal, period of typhoid fever the patient must have been discharging the germs of the disease. His case was believed by two thoroughly competent physicians who saw him, to have been well on "in the third week," on August 28th. His first hæmorrhage, so far as is known, was on the 29th, and he died September 6th. The cases first began to appear on the 16th, on which day physicians were called to five cases in Somerville; and seventeen out of the whole number of cases had their first visit from the physician on this day or one of the four following. Previous to this there had been only one case in Somerville since August 5th. It would appear from a consideration of the epidemic itself, that the milk must have been most heavily infected between the 1st and the 10th of August; and we have every reason to believe that at this time one of the milkmen was in the early stages of the disease. This is the more interesting because the great epidemics in Lowell and Lawrence in 1890–91 were apparently due to excreta thrown off in the early stage of the disease, before the patients took to their beds. The same thing was true of the epidemic in 1892 in Chicopee Falls, and also of the important epidemic in Red Hill and Caterham (Eng.) in 1879. In the present case I was told by his father that the young man had not been able to do anything at the milk house "for a week or so" before he ceased to deliver milk and went to bed; that is, not after about August 20th. The last case had its first visit from the physician on September 3d, or exactly two weeks afterwards. In other words, after this young man no longer visited the milk house the epidemic ceased. Later in September there were one or two more cases of typhoid fever in Somerville, but they proved on investigation to have been imported, having obviously contracted the disease elsewhere.

My thanks are due to several of the physicians of Somerville for their valuable assistance, especially to Medical Examiner Dr. T. M. Durell and Dr. William A. Bell.

Clinical Department.

SOME ABDOMINAL OPERATIONS.[1]

BY MAURICE H. RICHARDSON, M.D.

TUBERCULOUS STRICTURE OF THE INTESTINE.

I REMOVED a few days ago from a girl of twenty-two, at the New England Hospital for Women and Children, an unusual and interesting specimen of tuberculous stricture of the intestine. As one of the consulting surgeons, I was asked by Dr. Keller to see this patient, and, if thought advisable, to operate. The chief symptom was abdominal pain coming in violent paroxysms without apparent cause, accompanied by loud gurgling. There was great emaciation and weakness. Obstruction was not complete. Although I have seen cancer of the intestine at this early age, I eliminated malignant stricture in the differential diagnosis because of the strong tuberculous taint in the immediate family of the girl. I was prepared to resect the gut under favorable conditions, but expected to be limited to inguinal colostomy, postponing the more radical treatment until she could regain her strength. The local conditions were so favorable, however, that I performed immediate excision. The stricture was in the lower portion of the ileum, and was situated between the umbilicus and the anterior superior iliac spine. One or two enlarged mesenteric glands near the seat of disease were not removed.

Resection was rapidly performed. The joint by the interrupted Lembert silk stitch was unusually satisfactory. The line of suture was protected by gauze packing. The patient died in three days, without any evidence of peritonitis. Abundant evacuations followed almost immediately upon the operation.

I think it would have been better to relieve by colostomy the obstruction, and to wait till the increased strength of the patient should justify resection.

The specimen shows a great thickening of the intestinal walls, with dilatation, above the constriction; below, the bowel is collapsed and its walls are comparatively thin. The lumen at the point of constriction is hardly large enough to admit a probe. The bowel above was much distended by thin, yeasty fæces, which were being constantly churned up by the intestinal paroxysms. The only difficulty in suturing was caused by the great difference in the diameters of the cut ends.

[1] Remarks made before the Boston Society for Medical Improvement at its regular meeting Monday, May 22, 1892.